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Ultra-Processed Food Consumption And Non-Communicable Diseases: A Public Health Concern

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Abstract

Ultra-processed foods (UPFs) have become increasingly prevalent in diets worldwide, raising serious public health concerns. UPFs are characterized by high levels of added sugars, unhealthy fats, sodium, and synthetic additives, and their intake has been linked to a heightened risk of non-communicable diseases (NCDs) such as obesity, type 2 diabetes, hypertension, cardiovascular diseases, and certain cancers. Global consumption of UPFs has risen dramatically in the past few decades, now accounting for roughly half of daily caloric intake in some high-income populations. These foods are engineered for hyper-palatability and convenience but often lack essential nutrients, contributing to chronic inflammation, oxidative stress, and gut microbiome disruptions that underlie their association with NCDs. This review summarizes evidence from the past 15 years on UPF consumption trends (globally and in India), the health and nutritional impacts of UPFs, and the mechanisms by which they exacerbate NCD risk. Socio-economic and behavioral drivers of UPF consumption – including urbanization, affordability, convenience, and aggressive marketing – are also examined. Conclusions: UPF intake is strongly correlated with adverse health outcomes and represents an urgent challenge for public health. Reducing UPF consumption will require multi-sectoral strategies, from policy interventions (e.g. improved food labelling, marketing regulations) to public education and improved access to minimally processed foods. The paper also outlines key areas for future research to inform evidence-based policies and interventions on this critical issue.

Keywords: Ultra-processed foods (UPFs), Non-communicable diseases (NCDs), Obesity, Public health, Dietary trends, Food policy interventions

1. Introduction

Diets around the world have undergone a profound shift in recent years, marked by a surge in the consumption of ultra-processed foods (UPFs). UPFs are products formulated mostly or entirely from industrial ingredients and additives, with minimal whole foods. They include items like soft drinks, packaged snacks, instant noodles, and many fast foods (Shim, 2025). The rise of UPFs has paralleled the global epidemic of non-communicable diseases (NCDs), which now account for over 70% of all deaths worldwide. Numerous studies have documented strong associations between high UPF consumption and increased risks of obesity, cardiovascular disease, type 2 diabetes, cancers, and other chronic conditions. For example, a large prospective cohort study found that each 10% increase in the proportion of UPFs in the diet was associated with a 12% higher risk of cardiovascular disease and a 10% increase in all-cause mortality (Elizabeth *et al.*, 2020). These concerning findings underscore the need to understand the patterns, causes, and health impacts of UPF consumption, so that effective public health responses can be developed. This review provides an overview of how UPFs are defined and classified, examines global and regional trends in UPF intake (with a focus on India), reviews the evidence linking UPFs to major NCDs, explores biological mechanisms connecting UPFs to disease, and discusses the socio-economic drivers of UPF proliferation. Potential future research directions and policy implications are also highlighted.

2 Understanding Ultra-Processed Foods (UPFs)

Ultra-processed foods (UPFs) refer to packaged edible products that undergo multiple industrial processes and contain only trivial amounts of intact natural foods. According to the NOVA food classification system developed by Monteiro and colleagues, UPFs are “industrial formulations composed mostly of substances derived from foods (oils, fats, sugars, protein isolates) and additives (such as flavourings, colorants, emulsifiers, preservatives) with little or no whole foods”. In practice, UPFs include a wide array of modern convenience products – for instance, carbonated sodas, sweet or savoury snack chips, candies, mass-produced packaged breads and cookies, instant soups or noodles, processed meat products (hot dogs, nuggets), sugary breakfast cereals, and many ready-to-eat meals (Fiolet *et al.*, 2018). These products are designed to be highly palatable and have a long shelf life, often achieved by adding significant amounts of sugar, salt, unhealthy fats, and cosmetic additives (Elizabeth *et al.*, 2020). While convenient and tasty, UPFs are typically nutrient-poor relative to their high energy density; they tend to be low in fibre, protein, vitamins, and minerals but high in empty calories (from refined carbohydrates and fats) and various chemical additives. Regular consumption of such foods has therefore been implicated in poor diet quality and adverse health outcomes. To better characterize foods by their level of processing, researchers categorize all foods into groups using the NOVA classification, as described below(Monteiro *et al.*, 2019).

2.1 NOVA Classification of Foods

The NOVA system classifies foods into four groups based on the extent and purpose of processing:

- Group 1 – Unprocessed or Minimally Processed Foods: Edible parts of plants or animals that are consumed in their natural state or altered very little by processes such as drying, boiling, freezing, or pasteurization. No substances are added in processing. Examples: fresh or frozen vegetables, fruits, grains; eggs, milk; fresh meats, fish, and nuts.
- Group 2 – Processed Culinary Ingredients: Substances derived from Group 1 foods or nature through processes like pressing, refining, milling, or drying. These ingredients are used in home kitchens to season and cook other foods. Examples: vegetable oils, butter, sugar, salt, starches, honey.
- Group 3 – Processed Foods: Relatively simple products made by adding sugar, salt, oil, or other Group 2 ingredients to Group 1 foods. Processed foods are often canned, bottled, or otherwise packaged to increase shelf life or enhance flavour. They usually have just 2–3 ingredients. Examples: canned vegetables or fruits in syrup, salted nuts, cured meats (e.g. ham, bacon), artisanal cheeses, freshly baked bread.
- Group 4 – Ultra-Processed Foods (UPFs): Industrial products made with five or more ingredients, including substances not commonly used in home cooking. These undergo a series of industrial techniques (extrusion, molding, hydrogenation, etc.) and contain additives designed to make the final product highly palatable or long-lasting. UPFs often have artificial flavours, colors, sweeteners, emulsifiers, preservatives and other additives that simulate or enhance sensory qualities. Examples: carbonated soft drinks, packaged salty snacks (chips, crackers), candy and chocolate bars, instant noodles and soups, chicken nuggets and other reconstituted meat products, mass-produced packaged breads, cookies, cakes, breakfast cereals, and many “ready-to-heat” or “ready-to-eat” meals.

It is noteworthy that many traditional or homemade foods can become “ultra-processed” when produced at scale with industrial formulations. For instance, a simple bread made at home from flour, water, yeast, and salt (Group 3) differs from a factory-made packaged bread (Group 4) that contains high-fructose syrup, hydrogenated oil, emulsifiers, and preservatives. The NOVA classification has been widely adopted in nutrition research to distinguish these differences. Studies have found that diets high in UPFs (NOVA Group 4) are generally associated with poorer overall dietary quality and health outcomes compared to diets based on unprocessed or minimally processed foods.

3. Health Implications of UPF Consumption

Regular consumption of ultra-processed foods has been strongly linked to adverse health outcomes, particularly the development of obesity and other chronic NCDs. UPFs tend to be high in calories, added sugars, refined starches, and unhealthy fats, and low in fiber and micronutrients – a nutritional profile conducive to weight gain and metabolic dysfunction (Askari *et al.*, 2020). Moreover, many UPFs contain additives or neo-formed compounds that may have direct harmful effects (for example, certain preservatives, emulsifiers, or contaminants formed during processing). Epidemiological studies over the past decade have built a compelling case that high UPF intake is associated with increased risk of obesity, cardiovascular and metabolic diseases, and even some cancers. Below we summarize the evidence regarding four major health outcomes:

Obesity and Weight Gain

Diets rich in ultra-processed foods are consistently associated with higher rates of overweight and obesity. There are several reasons why UPFs promote weight gain. First, UPFs are calorie-dense and engineered to be hyper-palatable, leading to passive overconsumption. Many UPF products can be eaten quickly and in large quantities without inducing satiety (fullness) to the same degree as whole foods. For example, a randomized controlled trial by Hall *et al.* (2019) found that when adults were provided ultra-processed meals versus minimally processed meals (matched for calories and nutrients), they consumed about 500 kcal more per day on the ultra-processed diet and gained weight, whereas they lost weight on the unprocessed diet. This experiment demonstrated a causal link: UPFs cause overeating and weight gain, likely due to factors like faster eating rates, high energy density, and reduced appetite regulation. Second, UPFs often contain high levels of added sugars and fats (e.g. sugar-sweetened beverages, desserts, fried snacks), which contribute to a positive energy balance. Third, they lack fiber and protein that help signal satiety, so people do not feel as full and may eat more(Pagliai *et al.*, 2021) . In addition, frequent consumption of sugary drinks or refined snacks may dysregulate appetite and metabolism (e.g. through rapid spikes in blood glucose).

These mechanisms are reflected in population studies. Large-scale observational studies have found a clear association between UPF intake and obesity risk. For instance, a systematic review and meta-analysis of observational studies (Askari et al., 2020) concluded that individuals with the highest UPF consumption had significantly greater odds of being overweight or obese compared to those with the lowest intake. Similarly, a prospective cohort study of Spanish adults reported that each 10% increment in calories from ultra-processed foods corresponded to a 14% higher risk of developing obesity over a median follow-up period.

These findings, replicated in multiple countries, indicate that UPFs are a major contributor to excess caloric intake and weight gain at the population level.

Cardiovascular Diseases

High consumption of ultra-processed foods has also been linked to an increased risk of cardiovascular diseases (CVDs), including coronary heart disease and stroke. Nutritionally, many UPFs are high in compounds detrimental to cardiovascular health – for example, sodium, trans fats, and added sugars – and low in protective nutrients like potassium, fiber, and unsaturated fats (Chen *et al.*, 2022). Diets heavy in UPFs often contain excessive salt (from packaged snacks, instant noodles, processed meats, etc.), contributing to hypertension (high blood pressure), which is a major risk factor for stroke and heart disease. They may also include industrial trans-fatty acids (found in some margarines, baked goods, and fried snacks) that are known to raise LDL cholesterol and promote atherosclerosis. Furthermore, high sugar intake from UPFs (such as sodas and sweets) can lead to dyslipidaemia, insulin resistance, and visceral fat accumulation, all of which strain cardiovascular health (Qu *et al.*, 2024).

Epidemiological evidence supports a connection between UPFs and CVD. In a French prospective cohort study (NutriNet-Santé), people with the highest proportion of UPFs in their diet had significantly elevated rates of heart attacks, strokes, and other cardiovascular events compared to those with diets low in UPFs. Srour *et al.* (2022) reported about a 12% increase in risk of overall cardiovascular disease among individuals in the top quartile of UPF consumption. Similarly, a multi-country analysis by Machado et al. noted that higher national sales of ultra-processed foods per capita were correlated with higher mortality from circulatory diseases. The likely drivers are the poor nutrient profile of UPFs and their contribution to risk factors: for example, high salt and trans-fat intake from UPFs can elevate blood pressure and LDL cholesterol, while their tendency to promote obesity and diabetes further exacerbates cardiovascular risk. Notably, a recent meta-analysis concluded that diets high in processed and ultra-processed foods are associated with significantly greater risk of hypertension. On the other hand, reducing intake of these foods (and salt in particular) can lower blood pressure and improve cardiovascular outcomes. Altogether, the evidence suggests that minimizing ultra-processed foods in the diet would benefit heart health and reduce the incidence of CVD.

Type 2 Diabetes

There is growing evidence that consuming ultra-processed foods can increase the risk of type 2 diabetes. The link to diabetes is thought to operate through multiple pathways. One key factor is the glycemic impact of UPFs – many are high in rapidly digestible starches and added sugars (e.g. refined breads, sugary cereals, sweet snacks, soft drinks), which can lead to frequent post-prandial glucose spikes and eventually insulin resistance(Almarshad *et al.*, 2022). Diets rich in these high-glycemic-load foods put greater stress on the body's insulin-producing cells. Another factor is the effect of certain food additives on metabolism and the gut microbiome. Research suggests that some artificial sweeteners (commonly present in diet sodas and other UPFs) may adversely affect glucose metabolism and insulin sensitivity. Emulsifiers and other

additives used in UPFs have also been shown to disrupt the gut microbiota in animal studies, promoting inflammation and metabolic changes that can precipitate diabetes. Additionally, high consumption of processed meats and fats can lead to ectopic fat deposition and liver insulin resistance (Moradi *et al.*, 2021).

Several large cohort studies have observed a positive association between UPF intake and incidence of type 2 diabetes. For example, in a 2018 analysis of over 100,000 adults (part of the French NutriNet-Santé cohort), those in the highest UPF consumption group had a 15% greater risk of developing diabetes over ~10 years compared to those in the lowest group (adjusting for other risk factors). Another study from Spain reported that individuals who regularly consumed UPFs (especially sugar-sweetened beverages and fast foods) were more likely to develop metabolic syndrome and impaired glucose tolerance. The pro-diabetic effect of UPFs is partly mediated by their tendency to cause weight gain (obesity is a major risk factor for diabetes). But even beyond weight, the poor dietary quality and chemical exposures from UPFs seem to contribute to insulin resistance and beta-cell stress. In summary, while more research (especially clinical trials) is ongoing, current evidence indicates that cutting down on ultra-processed foods and replacing them with whole foods (fruits, vegetables, legumes, minimally processed grains) would likely help in diabetes prevention (Levy *et al.*, 2021).

Cancer

Emerging research has also linked high ultra-processed food consumption to an elevated risk of certain cancers. The relationship between diet and cancer is complex, but several characteristics of UPFs may contribute to carcinogenic processes. First, some UPFs contain known carcinogenic contaminants or additives. For instance, processed meats (like bacon, sausages, ham – which are considered UPFs) often contain nitrite preservatives that can form nitrosamine compounds, implicated in colorectal cancer (Isaksen and Dankel, 2023). High-temperature processed snacks or fried foods may contain acrylamide, a probable carcinogen formed during intense heating of starches. Second, diets high in UPFs tend to be low in protective nutrients (such as fiber, antioxidants, and phytochemicals found in fruits, vegetables, and whole grains) that have cancer-preventive effects. Third, the pro-inflammatory and obesogenic nature of UPFs can create an internal environment conducive to cancer development. Chronic inflammation and insulin resistance (fuelled by poor diet) are known to promote tumour growth in various tissues.

A notable study published in The BMJ (Fiolet *et al.*, 2018) examined cancer incidence in relation to UPF consumption in a large cohort of over 100,000 French adults. It found that for every 10% increase in the proportion of ultra-processed foods in the diet, there was a 10% increase in the risk of overall cancer (and a slightly higher increase in breast cancer risk specifically). Importantly, this association remained significant even after adjusting for other factors like socioeconomic status, total calories, and body weight, suggesting that UPFs might have an independent effect on cancer risk. Another analysis using UK Biobank data similarly found that higher UPF intake was correlated with greater risk of developing obesity-related cancers

and also with higher all-cause mortality after a cancer diagnosis. While research in this area is still developing, these findings raise concern that certain components of ultra-processed foods – potentially chemical additives or compound interactions – could be contributing to carcinogenesis. Reducing consumption of processed meats, sugary drinks, and other UPFs (while increasing fiber-rich foods) is already a recommendation in some dietary guidelines for cancer prevention. Ongoing studies are attempting to pinpoint which aspects of UPFs (nutritional or non-nutritional) are most responsible for the observed increase in cancer risk (Fiolet *et al.*, 2018)

3. Underlying Mechanisms Linking UPFs to NCDs

Why might ultra-processed foods have such deleterious effects on health? Researchers have proposed several biological mechanisms through which high UPF diets can drive the development of chronic diseases. These mechanisms are interrelated and often stem from the inherent qualities of UPFs (nutrient imbalance, additives, processing contaminants, etc.):

- **Chronic Inflammation**: Diets high in UPFs can provoke a state of persistent low-grade inflammation in the body. One reason is that UPFs often contain substances like advanced glycation end-products (AGEs) and oxidizedfats, which can trigger pro-inflammatory pathways. Additionally, a lack of anti-inflammatory nutrients (e.g. omega-3s, antioxidants, fiber) in UPF-heavy diets means the immune system is not kept in check. Over time, this inflammation can damage tissues and is recognized as a key factor in insulin resistance, atherosclerosis, and even tumor growth. Studies have shown that people consuming more UPFs tend to have elevated levels of inflammatory markers like C-reactive protein (CRP) compared to those eating unprocessed diets (Xia *et al.*, 2025). Furthermore, UPFs may disrupt gut microbial balance (as discussed below), leading to endotoxin release and inflammation. In short, ultra-processed diets create a pro-inflammatory internal environment conducive to many NCDs.

- **Oxidative Stress:** Excessive intake of UPFs can upset the oxidative balance in cells. Many UPFs are deficient in natural antioxidants (vitamins C, E, polyphenols, etc.) found in whole plant foods. At the same time, they may introduce pro-oxidant compounds or promote metabolic states that generate reactive oxygen species (ROS). For example, high-sugar and high-fat meals can spike postprandial oxidative stress (Quetglas-Llabrés *et al.*, 2023). Over time, a diet lacking fruits, vegetables, and whole grains (and instead filled with processed items) means the body's antioxidant defence capacity is reduced. The resulting oxidative stress – an overload of ROS that damages proteins, lipids, and DNA – is a known contributor to aging and chronic diseases like CVD, cancer, and neurodegeneration. Research suggests that UPF-heavy diets correlate with greater oxidative damage and lower circulating antioxidant levels (Ahmed *et al.*, 2024). Reducing UPFs and improving diet quality can help restore redox balance and prevent cellular damage associated with NCDs.

- **Gut Microbiota Dysbiosis:** The gut microbiome is increasingly recognized as a mediator between diet and chronic disease. Ultra-processed foods can adversely affect the gut microbiota composition and function. Diets high in fiber from diverse whole foods tend to foster a healthy, diverse microbiome, whereas diets high in ultra-processed products (with low fiber and various additives) can lead to loss of beneficial microbes (Rondinella *et al.*, 2025). UPFs often contain emulsifiers, artificial sweeteners, and preservatives that may disrupt gut bacteria. Studies have found that consuming lots of UPFs is associated with reduced microbial diversity and a shift towards bacteria that produce pro-inflammatory metabolites . For instance, high-fat and high-sugar processed diets can increase gut permeability ("leaky gut") and allow bacterial endotoxins into circulation, triggering inflammation. Some emulsifiers used in packaged foods have been shown to thin the mucus layer of the gut and promote intestinal inflammation in animal models. This dysbiosis (microbial imbalance) is linked to metabolic disorders: a less diverse, inflammation-prone microbiome can impair insulin sensitivity and is connected to obesity and diabetes development. It may also influence cardiovascular risk factors and even brain health. Thus, the disruptive impact of UPFs on gut health is a plausible mechanism for their role in multiple NCDs. Improving diet quality by cutting ultra-processed items and eating more fiber-rich whole foods can help restore a healthier microbiome, which in turn supports metabolic and immune homeostasis (Bevilacqua *et al.*, 2024).

These mechanisms are not mutually exclusive – in fact, they likely interact. For example, a dysbiotic gut microbiome can lead to inflammation and oxidative stress; inflammation can further induce oxidative damage; and both can drive insulin resistance and tissue damage. Ultra-processed diets, by simultaneously promoting all these deleterious processes, create a perfect storm for chronic disease development. In contrast, diets based on minimally processed foods tend to be anti-inflammatory, antioxidant-rich, and supportive of gut health, which helps explain their association with lower NCD risk. Understanding these pathways is important not only scientifically but also to communicate to the public why ultra-processed foods are harmful beyond just their calorie content.

5.Socio-Economic and Behavioral Drivers of UPF Consumption

Identifying why ultra-processed foods have become so dominant in modern diets is crucial for designing interventions. The rise in UPF consumption is driven by a complex mix of socio-economic, cultural, and behavioral factors:

- **Urbanization & Lifestyle Change**: The migration of populations to urban areas and the modernization of lifestyles have greatly increased reliance on UPFs. Urban living is often fast-paced, with less time for traditional meal preparation. In cities, people are surrounded by convenience

stores, supermarkets, and fast-food outlets offering ready-to-eat products (Purushotham *et al.*, 2023). As a result, busy working adults frequently replace home-cooked breakfasts or lunches with packaged snacks, instant noodles, or restaurant fast food. Urban centers also expose people to more advertising and availability of UPFs than rural areas. Additionally, globalization has introduced Western dietary patterns (rich in processed foods) to countries undergoing economic development. The net effect is a nutrition transition: as societies urbanize and incomes rise, diets shift from staple whole foods towards meats, oils, sugars, and ultra-processed commodities (Ilieva *et al.*, 2025).

- **Affordability:** Many ultra-processed foods are formulated to be inexpensive and accessible, making them attractive, especially to lower-income consumers. Food manufacturers achieve low prices through economies of scale and use of cheap ingredients (refined grains, sugar, industrial oils) subsidized in many countries. In contrast, fresh whole foods can be relatively costly or have higher spoilage and preparation costs (Shannon and Avery, 2025). For low-income families, filling up on packaged snacks, instant noodles, or fast-food meals often appears more convenient and sometimes cheaper in the short term than purchasing an assortment of fresh produce and lean proteins. This economic reality drives higher UPF consumption in disadvantaged communities, contributing to health inequities(Colozza, 2024). Public health surveys have noted that as the price of UPFs drops (or as household income stagnates), people tend to buy more of them because they deliver calories per dollar at a very tempting ratio.

- **Convenience and Time Constraints:** UPFs fit perfectly into modern on-the-go lifestyles. They typically require little to no preparation – just open a package, microwave a meal, or grab a ready-made snack. This convenience is a major selling point for consumers who are juggling work, school, or other responsibilities and have limited time to cook. For dual-income families or urban professionals, ultra-processed options save time and effort compared to cooking from scratch. The food industry has capitalized on this by marketing UPFs as solutions for busy lives (e.g. “just heat and eat”). Over time, such foods can displace traditional cooking skills and habits. In many places, younger generations are less inclined or able to cook daily meals, relying instead on the convenience food culture(Shannon and Avery, 2025). Thus, time pressure and changing social norms around cooking have fueled UPF demand.

- **Aggressive Marketing:** The marketing and advertising of ultra-processed food products is pervasive and powerful. Global food and beverage corporations spend billions annually to promote sodas, snacks, candies, and fast-food brands via television, online media, billboards, and sponsorships. These marketing campaigns often specifically target children and adolescents (through colorful packaging, cartoon mascots, celebrity endorsements, etc.), creating brand loyalty from an early age. In low- and middle-income countries, multinational companies have rapidly expanded their marketing reach, presenting ultra-processed snacks and drinks as aspirational and modern. This commercial pressure has

pervaded societies worldwide, shifting cultural preferences towards UPFs at the expense of traditional foods. Studies note that in many developing countries, exposure to advertisements for sugary drinks and snacks now far exceeds that for healthier foods. The ubiquity of vending machines, convenience stores, and fast-food franchises – all backed by marketing – ensures that UPFs are constantly visible and attractively portrayed in daily life. Consequently, people's eating preferences and cravings are shaped by this food environment engineered by the industry. Marketing not only increases demand but also normalizes ultra-processed foods as a staple part of the diet(Srour *et al.*, 2022).

- **Policy and Regulatory Gaps:** The rapid infiltration of ultra-processed foods has in many cases outpaced public policy responses. In many countries, inadequate regulations on food labeling, composition, and advertising have allowed the unfettered growth of UPF availability. For instance, in places without clear front-of-pack nutrition labels, consumers may not realize how unhealthy some products are. Loose regulation on marketing means companies can advertise junk foods to children without restriction in many markets. Agricultural and trade policies sometimes favor commodity ingredients for processed foods (like corn syrup, palm oil) through subsidies or trade deals, making those ingredients cheap and abundant. At the same time, there may be insufficient policy support for fresh food production and distribution. The relative lack of taxes on sugary drinks or ultra-processed snacks (with notable exceptions in a few countries) fails to disincentivize consumption. In summary, policy deficiencies and weak governance of the food industry have facilitated the spread of UPFs (Ilieva *et al.*, 2025). Only recently have some governments started to enact measures (e.g. soda taxes, marketing bans to children, school junk food bans) – but these remain the exception rather than the norm globally

It is important to recognize that these drivers often interact. For example, urbanization and globalization create the setting for greater marketing influence; low-income pairs with convenience needs to push people towards cheap UPFs; and industry lobbying often keeps policy responses at bay. The dominance of ultra-processed foods in the global diet is thus a multifaceted issue rooted not just in individual choice but in broader systemic factors. Efforts to reduce UPF intake will need to address these underlying drivers – making healthier foods more accessible and affordable, educating consumers, and enacting smart policies to reshape the food environment

5. Conclusion

The growing consumption of ultra-processed foods poses a serious threat to global public health, given their strong correlation with the rising incidence of non-communicable diseases. The evidence amassed over the last 15 years indicates that diets high in UPFs are associated with greater risks of obesity, type 2 diabetes, cardiovascular disease, and certain cancers. The mechanisms behind these detrimental health effects include

the poor nutritional quality of UPFs – excessive calories, sugar, unhealthy fats, and salt coupled with a lack of fiber and micronutrients – as well as the generation of chronic inflammation, oxidative stress, and gut dysbiosis in the body as a result of consuming these products. In essence, ultra-processed diets help create the metabolic conditions that drive NCD development.

The socio-economic factors propelling the global shift toward UPF-based diets (notably affordability, convenience, and aggressive marketing) mean that ultra-processed foods have become deeply embedded in modern lifestyles, especially among urban and working-age populations. In many communities, UPFs fill important needs – they are shelf-stable, quick to prepare, and appealing to taste – which makes addressing their overconsumption challenging. Nevertheless, the evidence is now compelling that reducing UPF intake is critical for combating obesity and chronic diseases. The status quo, in which UPFs are displacing traditional minimally processed foods around the world, undercuts efforts to improve population nutrition and health. Without intervention, the healthcare burden attributable to diet-related NCDs will continue to climb as more people adopt ultra-processed-heavy diets.

Tackling this issue will require a comprehensive, multi-sectoral strategy that puts public health interests above commercial agendas. First, policy and regulatory measures are essential. Governments should implement and enforce policies such as clear front-of-pack labeling of unhealthy products, restrictions on marketing ultra-processed foods (especially to children), and fiscal policies like sugar taxes or subsidies for healthier staples, to discourage excessive UPF consumption. Food reformulation targets (e.g. limits on trans fats, salt, and added sugars in products) can also push industry to improve the nutritional profile of processed foods. Second, public health education and awareness campaigns are needed to inform consumers about the risks of ultra-processed diets and to promote a return to wholesome, traditional dietary patterns. Reviving cooking skills, encouraging consumption of fresh foods, and dispelling the notion that convenience foods are harmless are important steps. Third, improving the food environment and access to healthy options is crucial. This includes supporting local markets and supply chains for fruits, vegetables, and other minimally processed staples, so that these are affordable and readily available alternatives to UPFs in all communities. Schools and workplaces should be leveraged as sites to provide and promote healthier, minimally processed meals.

Ultimately, shifting population diets away from ultra-processed products will not be easy – it challenges powerful industry interests and ingrained habits. However, the potential benefits are enormous. By re-emphasizing whole and minimally processed foods in diets, countries can curb the rising tide of NCDs, reduce healthcare costs, and improve the quality of life of their citizens. The experience of some countries (like Chile's aggressive food marketing regulations or Brazil's dietary guidelines explicitly advising to avoid UPFs) offers hope that policy actions can make a difference. In conclusion, prioritizing unprocessed or minimally processed foods and limiting ultra-processed items should become a key pillar of public health strategies worldwide. Such a realignment of diets – akin to turning back the clock on the most harmful

aspects of the industrial nutrition era – is essential for protecting future generations from the burden of chronic disease.

By pursuing these research avenues, scientists and public health experts can deepen the evidence base needed to combat the ultra-processed food epidemic. The ultimate goal of future research is not only to illuminate the problems caused by UPFs but also to identify practical solutions – be it through policy, technology (e.g. developing healthier processed foods), or education – that can help populations move toward healthier, less processed diets

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